Concerns about immunisation

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Immunisation against infectious disease has probably saved more lives than any other public health intervention, apart from the provision of clean water.[1] Although other factors were important, it would not have been possible to eradicate smallpox without vaccination; the eradication of wild polio from the western hemisphere is largely due to immunisation; and the immense reductions in *Haemophilus influenzae* type b infections, diphtheria, whooping cough, and measles are also evidence of the value of immunisation.

Despite, or perhaps because of, the success of the immunisation programme in the United Kingdom a vocal minority of parents have cast doubt on the wisdom of having their children immunised, particularly with the measles, mumps, and rubella vaccine.[2] Not only does this place their own children at risk, but if a significant number of children remain unimmunised it poses a risk to the general population.[3] In this article we suggest how health professionals, particularly those within the primary healthcare team, can respond to parents' concerns.

Summary points

- Immunisation has saved millions of lives
- The routine vaccines are safe
- The eradication of diseases preventable by vaccines throws undue prominence on unconfirmed adverse reactions
- Vaccine scares are common
- Parental concerns should be taken seriously
- Health professionals have a duty to provide accurate information to enable parents to make a truly informed decision about their child's vaccinations

Methods

Our approach is based on a number of surveys showing the reasons for non-immunisation,[4 5] books,[2 6] articles written by those antagonistic to vaccination,[7 8] and personal experience of talking to thousands of parents. Information used to respond to parental concerns (box 1) is based on extensive knowledge of both "mainstream" and "fringe" literature.

Box 1: Parental objections to immunisation and response to these objections

The disease is not serious
Measles can kill healthy children.

The disease is uncommon
Diseases such as measles, diphtheria, and polio are common in unimmunised populations and are easily spread worldwide.

The vaccine is ineffective
Before their introduction all vaccines undergo rigorous trials to show that they are effective.

The vaccine is unsafe
Before their introduction all vaccines are assessed for safety, and monitoring continues after their introduction.

Other methods of disease prevention, such as homoeopathy, are preferable to immunisation
The Faculty of Homoeopathy supports the use of orthodox vaccines—there is no evidence that homoeopathic vaccines confer long term or short term protection.

Importance of the diseases

According to a government information film, before the introduction of the diphtheria vaccine in 1940 one child caught diphtheria every 15 minutes and one died every five hours. Since 1970 only nine deaths have resulted from diphtheria, the last in an unimmunised child in 1994.[9] Measles has killed a quarter of a million children in England and Wales this century, but such deaths in the United Kingdom are now rare. Improvements in living standards have reduced the mortality from infectious diseases, but immunisation has also played a large part in the reduction of disease incidence (table 1). Paradoxically, the success of immunisation programmes means that many parents and health professionals have no experience of many of the diseases preventable by immunisation and so do not appreciate how damaging these can be. For example, some consider measles a benign disease,[2] and one that may even enhance a child's immune system, yet of the 270 people who died from measles between 1970 and 1983, 144 (53%) were healthy children with no predisposing illnesses.[10]

Efficacy of vaccines

Many parents point out that some infectious diseases were on the decline before the relevant vaccine was introduced and so how can it be certain that immunisation has had any effect. Before a vaccine is introduced it undergoes trials to ensure it has a reasonable efficacy. Trials of all the routine childhood vaccines in use today have shown them to be highly efficacious (box 2). Before the introduction of whooping cough vaccine, studies showed that it provided a high degree of protection.[11] More recently trials have confirmed its high efficacy.[12 13] Although protection against infection is not 100%, the symptoms and signs of the disease in a child who has completed a course of three doses of the whole cell vaccine used in the United Kingdom are almost always milder than those in an unimmunised child.

Several disease outbreaks have occurred in populations that were unimmunised but otherwise healthy—for example, in the past 25 years two outbreaks of paralytic polio occurred in an unimmunised religious community in the Netherlands.[15] In neither case did the disease spread outside the community. The Amish and other religious groups that eschew immunisation have also had a disproportionately large number of cases of whooping cough, measles, and congenital rubella.[16–18]

Some outbreaks of diseases, particularly measles and whooping cough, have taken place in highly immunised populations. When a large percentage of those affected have been immunised it is often inferred as proof that the vaccine is not efficacious. Even if a large percentage of the general population is immunised, unless the vaccine is 100% effective a large proportion of infected children will have been immunised. The numbers of immunised and non-immunised children infected in these outbreaks invariably shows that these vaccines have a high efficacy—for example, in an outbreak of measles in Quebec City in 1989 of 62 siblings of children with measles who developed measles themselves, 41 (66%) were immunised.[19] This might suggest that the vaccine was not effective, but of 17 unvaccinated siblings all (100%) developed measles, whereas only 41 of 441 (9%) vaccinated siblings did so. This gives a vaccine efficacy of 91%. If none of the children had been vaccinated a further 400 cases would have occurred.

Importantly, not all preparations of a vaccine are the same. Although little variation occurs in measles vaccines used in the developed world, the efficacy of different pertussis vaccines varies enormously. Recent trials showed that one variety of pertussis vaccine had an efficacy of 35%-40%, whereas the two types used in the United Kingdom had over 90% efficacy.[12 13] The Jeryl Lynn mumps vaccine used in the United Kingdom has an efficacy of over 90%, whereas a recent study shows the Rubini strain to offer no protection.[14]

Safety of vaccines

Because many of the diseases preventable by vaccines are now uncommon, parents have little experience of the disease and so potential, however tenuous, side effects take on a disproportionate importance. Many conditions with an onset in early childhood, such as autism, convulsions, and sudden infant death syndrome, do not have an obvious cause. As children are immunised at a time when these disorders manifest themselves for the first time it is inevitable that on occasion their onset follows immunisation. It may then be assumed that immunisation caused the problem.

The scare following publication of the mistaken theory that pertussis vaccine was a significant cause of brain damage is an example of what can happen when preliminary research is made public.[20] Some children died unnecessarily because their parents refused to have them vaccinated.[21] Another example is the current controversy over the measles, mumps, and rubella vaccine and autism and bowel problems. This is largely based on one paper in which the authors themselves stated they had not proved a link between autism and the vaccine.[22] Despite this, one of the authors advised that parents should only allow their children to have the single antigens, each separated by an interval of at least a year. This minority view has received disproportionate publicity, giving the impression that a substantial body of medical opinion shares this

Table 1 Reduction in mortality and disease incidence after introduction of immunisation

	Last year before immunisation			After immunisation		
Disease	Year	Deaths (all ages)	No of cases	Year	Deaths (all ages)	No of cases
Diphtheria	1939	2 133	47 061	1996	0	12
Tetanus	1960	32	†	1996	0	8
Pertussis	1956	92	92 410	1996	2	2387
Haemophilus influenzae meningitis	1991	22	417	1996	0	38
Measles	1967	99	460 407	1996	0	5613
Tuberculosis	1952	10 590	48 093	1996	420	5859
Congenital rubella syndrome*	1971	—	162	1996	—	21

Sources: Office for National Statistics, Public Health Laboratory Service, and national congenital rubella surveillance programme.
*Cases of congenital rubella syndrome and terminations related to rubella infection.
†Not notifiable until October 1968.

Box 2: Efficacy of routinely used vaccines*

Diphtheria: 87%-96%

Tetanus: >90%

Pertussis: 35%-96%
Recent studies have shown that pertussis vaccines currently in use in the United Kingdom have efficacies of over 90%

***Haemophilus influenzae* type b (conjugate vaccines):** 94%-100%
The polyribosylribitol phosphate-diphtheria toxoid conjugate vaccine (not used in the United Kingdom or the United States) may have a lower efficacy in some populations

Oral polio: 90%-100%
Oral polio vaccine seems to be less immunogenic in developing countries

Measles: 90%-95%

Mumps: 90%-98%
The Rubini strain of vaccine virus has a lower efficacy—in fact, a general study showed it to have no protective efficacy[14]

Rubella: >95%

BCG (Bacille Calmette-Guérin): 0%-80%
In British schoolchildren efficacy has been found to be almost 80%, whereas a study in schoolchildren in Georgia in the United States showed no protective effect

*A wide range of efficacies has been reported, depending on vaccine, conditions of use, and target group (for further data on efficacy see Plotkin and Orenstein)[1]

concern. Sensational newspaper headlines and coverage in television programmes give the theory undue prominence, and it is no surprise that the uptake of measles, mumps, and rubella vaccination has declined.[23] To counter this it is necessary to explain to parents why the research is flawed and that there is no evidence of a link between the vaccine and autism. The methodology of the study was such that a link between the vaccine and autism could not be proved.[24] More recent data on the pattern of autism in several countries, for example, Sweden,[25] does not suggest a link between the vaccine and autism. In Finland, follow up of children who developed diarrhoea after measles, mumps, and rubella vaccination showed that none went on to have autism, and bowel symptoms lasted a maximum of six weeks.[26] A recent study from north London produced strong evidence of no link between autism and the measles, mumps, and rubella vaccine.[27]

As with any drug, monitoring of safety continues after a vaccine has been introduced. Reports of any suspected adverse events are notified to the Committee on Safety of Medicines using the "yellow card" system. As in all passive systems, underreporting is a major problem and at its best the system can only serve to flag up possible issues for further examination. Studies linking hospital admissions and immunisation records have been used to look at the relation between specific conditions and immunisation.[28] In this way the true incidence of adverse reactions can be determined (table 2). This system is greatly superior to that of the yellow cards.

Table 2 Specific examples of adverse events and immunisation

Vaccine	Adverse effect of immunisation	Rate due to immunisation
Pertussis	Convulsion	1 in 12 500*
Measles, mumps, and rubella	Convulsion	1 in 3 000
Measles, mumps, and rubella	Idiopathic thrombocytopenia	1 in 29 000

*Figure covers period when schedule changed from last dose being given at 10 months to being given at 4 months: risk of convulsions at 4 months is only 25% of risk at 10 months.

Other concerns that have been raised include possible long term effects such as asthma and overloading or damaging the immature immune system.[29] After birth, infants are constantly exposed to antigens. The number of antigens contained even in the combination vaccines is small compared with the number normally encountered every day. By giving a vaccine—that is, a carefully controlled dose of antigen—this assault is substantially reduced. A double blind randomised controlled trial in which some children were given diphtheria, tetanus, and pertussis vaccine and others diphtheria and tetanus vaccine showed no difference in the proportions of children with wheezing, itchy rash, or sneezing at two and a half years old.[30] These children will be reviewed when they are 7 years old.

Contraindications to vaccines

There are few reasons for refraining from vaccinating a child. Contraindications are uncommon (box 3) and most children in whom there is a true permanent contraindication will be under the care of a paediatrician.[31] When a child has had a reaction to a vaccine that is severe enough to contraindicate further doses this should be notified to the Committee on Safety of Medicines. Unfortunately several mythical contraindications (box 4) have sprung up over the years[32] and this has prevented some children from being immunised.

Box 3: Contraindications to immunisation

All vaccines
- Acute febrile illness (defer)
- Serious reaction to a previous dose or a constituent of the vaccine

Pertussis
- Evolving neurological problem: such children should always be under the care of a paediatrician, and the vaccine should be given once the condition is stable

All live vaccines
- Pregnancy
- Immunosuppression: such children should always be under the care of a paediatrician

BCG
- Previous BCG with a scar
- Positive tuberculin test

Box 4: Mythical contraindications to immunisation
- Has already had the disease (applies only to BCG vaccine)
- Personal or family history of atopy
- Personal or family history of epilepsy
- Minor upper respiratory tract symptoms at the time of immunisation
- Significant reaction to another vaccine

Alternatives to vaccination

Some parents believe that there are ways of protecting a child against infection that work equally as well as vaccines, one of the commonest being homoeopathy. There is no evidence that homoeopathy can prevent a child from becoming infected with a disease that is preventable by vaccination or that it can reduce the severity of a disease. The Faculty of Homoeopathy acknowledges this[33] and recommends the use of conventional vaccines.[34] Hahnemann, the founder of homoeopathy, was a supporter of smallpox vaccination.[35]

Conclusion

Overwhelming evidence shows the benefits and safety of routine childhood vaccination. Many parents, however, worry about the risks from some vaccines. Although this concern is mistaken, these are genuine worries and should be treated seriously and sympathetically. Health professionals have a responsibility to provide parents with accurate information on which to base their decision.

Competing interests: DE and HB have both been sponsored to attend and speak at educational meetings and have conducted research financed by manufacturers of vaccines.

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My most unfortunate mistake

Not thinking of things

I was fortunate enough to practise medicine for several years in the Himalayas, and many of my patients were Tibetan refugees, employed by the Indian government on road building and repair. One of my first patients was a man with swollen gums and tender thighs, the latter showing a diffuse dusky discoloration. I was puzzled by this combination, and more with hope than conviction, I gave him some iron tablets. In the evening my pharmacist diplomatically remarked that I might find many Tibetans suffered from scurvy. I took the hint, and had the immense gratification of seeing many similar patients miraculously restored to health by ascorbic acid and dietary advice.

Some years after I returned to England, an elderly man was brought to me complaining of aching in his thighs, which on examination showed a diffuse dusky discoloration. Eventually I referred him to a physician who, to his credit, sent me a letter saying the patient was suffering from scurvy. It seemed that his preferred diet consisted of bread and butter and tea.

The physician had probably seen only a handful of cases of scurvy in his lifetime, whereas I had seen hundreds—but not in England. They say that most mistakes in medicine are made not through ignorance but through not thinking of things.

T Peter Snell *retired general practitioner, Abergavenny, Gwent*

We welcome articles of up to 600 words on topics such as *A memorable patient, A paper that changed my practice, My most unfortunate mistake*, or any other piece conveying instruction, pathos, or humour. If possible the article should be supplied on a disk. Permission is needed from the patient or a relative if an identifiable patient is referred to. We also welcome contributions for "Endpieces," consisting of quotations of up to 80 words (but most are considerably shorter) from any source, ancient or modern, which have appealed to the reader.